

GAO

Report to the Chairman, Committee on  
Governmental Affairs, U.S. Senate

October 1993

# NUCLEAR WEAPONS

## Safety, Technical, and Manpower Issues Slow DOE's Disassembly Efforts



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**Resources, Community, and  
Economic Development Division**

B-253531

October 20, 1993

The Honorable John Glenn  
Chairman, Committee on  
Governmental Affairs  
United States Senate

Dear Mr. Chairman:

This report responds to your request that we review how the Department of Energy is addressing the disassembly of large numbers of retired nuclear weapons. Specifically, this report discusses (1) the Department's success to date in meeting the disassembly schedule and the causes of shortfalls, (2) issues that could affect the Department's ability to meet the disassembly schedule in the future, and (3) uncompleted safety analysis reports at disassembly facilities.

Unless you publicly announce its contents earlier, we plan no further distribution of this report until 30 days from the date of this letter. At that time, we will send copies of this report to the Secretary of Energy and the Director, Office of Management and Budget. We will make copies available to others on request.

This work was performed under the direction of Victor S. Rezendes, Director, Energy and Science Issues, who can be reached at (202) 512-3841 if you or your staff have any questions. Major contributors to this report are listed in appendix I.

Sincerely yours,

A handwritten signature in black ink, appearing to read 'J. Dexter Peach'. The signature is written in a cursive, flowing style.

J. Dexter Peach  
Assistant Comptroller General

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# Executive Summary

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## Purpose

Recent treaties and nuclear weapons retirements have resulted in dramatic reductions in the nation's nuclear weapons arsenal. To accommodate the weapons reductions, the Department of Energy (DOE) has begun the largest nuclear weapons disassembly effort since the beginning of the Cold War. As a result, the Chairman of the Senate Governmental Affairs Committee asked GAO to provide information on (1) DOE's success to date in meeting the disassembly schedule and the causes of any shortfalls, (2) issues that affect DOE's ability to meet the disassembly schedule, and (3) uncompleted safety analysis reports.

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## Background

DOE is responsible for researching, developing, testing, assembling, and disassembling nuclear weapons. After a weapon is retired, it is shipped to a DOE facility. In general, for weapons disassembly, the procedures to assemble a nuclear weapon are reversed. Initially, the various major components are mechanically separated. The component containing the plutonium pit and the high explosive is taken to a disassembly cell, where the high explosive is removed from the pit. When this process is completed, the weapon is considered to be disassembled, and the various components are either stored or destroyed. International treaties and nuclear weapons retirements are reducing the nation's nuclear arsenal from about 21,000 weapons in 1990 to a planned stockpile of 3,500 in 2003.

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## Results in Brief

DOE has established a very ambitious schedule for disassembling retired nuclear weapons at its Pantex facility in Texas. During fiscal year 1992, about 63 percent of the weapons scheduled were disassembled. Disassembly at Pantex was curtailed by a transportation problem that prevented the delivery of retired weapons to Pantex for about 2 months. As a result, Pantex slowed considerably its disassembly operations to avoid depleting its inventory of weapons to be disassembled. Unexpected problems that could cause disassembly technicians to be exposed to radioactive material also curtailed disassembly efforts.

DOE has scheduled the number of disassemblies to be conducted at Pantex for the next 10 years. The disassembly schedule for the first year is firm in terms of numbers and weapon type. According to DOE officials, the remaining years are more likely to change in terms of the numbers and types of weapons planned for disassembly. The prospect for meeting the schedule in the next several years is not good. DOE will have to address several issues that could decrease its capability to disassemble nuclear weapons. These issues include a shortage of disassembly technicians and

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problems concerning the adequacy of facilities for and the environmental impact of storing large amounts of plutonium at Pantex.

Safety analysis reports establish a basis to determine that a facility can operate safely. The completion of safety analysis reports is a continuing problem at the Pantex facility, as more than 50 percent of the required reports have not been completed. Many of the uncompleted safety analysis reports are for disassembly activities or facilities.

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## GAO's Analysis

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### Transportation and Safety Problems Slow Disassemblies

During fiscal year 1992, transportation and safety problems limited the number of disassemblies at Pantex to about 63 percent of those originally scheduled. DOE revised the schedule several times during the year; however, Pantex was only able to disassemble about 81 percent of the revised schedule. In the summer of 1991, a special trailer carrying nuclear weapons experienced an operational failure that caused concern about DOE's entire trailer fleet. Correcting the problem resulted in a shutdown of all weapons transportation by DOE for about 60 days and decreased the number of weapons disassembled in fiscal year 1992 by about 100.

Several safety problems also affected Pantex's disassembly operations. A faulty valve that could have allowed material to escape from a reservoir and enter the pit, radioactive material posing a threat of contamination to technicians, and a dropped weapon presented unanticipated safety risks that shut down disassembly operations and further reduced the total number of weapons disassembled at Pantex in fiscal year 1992.

In an effort to increase disassemblies, DOE increased the number of weapons disassembled at its Oak Ridge facility to about 580 percent of the scheduled number and postponed quality assurance tests at Pantex to make additional staff available for retired weapons disassemblies. Despite these efforts, only about 86 percent of the total disassemblies originally scheduled for Pantex and Oak Ridge were completed.

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### Several Issues Could Impede Future Disassembly Operations

DOE plans to continue its ambitious disassembly schedule for the next several years. To accomplish this schedule, DOE will have to address issues relating to weapons disassembly and special nuclear materials storage that

could impair Pantex's disassembly capabilities. The issues include (1) a shortage of disassembly technicians, (2) technical concerns about weapons disassembly, and (3) the safety and environmental implications of storing large quantities of plutonium at Pantex.

According to Pantex officials, hiring, training, and providing security clearances to a sufficient number of weapons disassembly technicians are the biggest challenge facing Pantex as it increases its disassembly work load. In addition to the inherent staffing demands of an increasing disassembly work load, Pantex experienced unexpected attrition during 1991 and 1992. Pantex plans to transfer 33 technicians to disassembly operations at Pantex and hire 13 new technicians to make up for that attrition.

Technical problems could also challenge Pantex's ability to meet future disassembly schedules. During fiscal year 1993, Pantex was to operate fewer disassembly "lines," allowing it to dispose of a larger number of a few types of weapons. Pantex had planned to run four lines during fiscal year 1993, but a safety question resulting from a disassembly problem with a particular weapon system reduced that number to three lines. Pantex had planned to disassemble a large number of W-48 weapons during 1993. However, in November 1992, technicians discovered a crack in a W-48 pit. The disassembly of all W-48s was halted and will not be resumed until fiscal year 1994.

As a result of the nuclear weapons disassembly program, great quantities of plutonium will require safe and secure storage. DOE currently plans to store the plutonium pits at Pantex until a long-term storage site is identified. To store all of the pits in existing facilities at Pantex, however, additional storage capacity will be needed, and a safety analysis report and an environmental assessment for the storage site must be completed. If these items are not completed in a timely manner, Pantex will run out of storage space, and disassembly efforts will have to be curtailed. In addition, Texas state officials are concerned over the environmental and safety impacts of storing a large amount of plutonium at Pantex. If these concerns affect plutonium storage at Pantex, disassembly activities could also be adversely affected.

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### Safety Analysis Reports Are Incomplete for Many Disassembly Facilities

Safety analysis reports are important because they establish a basis to determine that a facility can operate safely and to conclude that operating the facility does not pose an unacceptable risk to public health and safety.

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Completing safety analysis reports has historically been a problem at DOE's Pantex facility. This problem still exists as Pantex currently has completed fewer than 50 percent of the required safety analysis reports. The completion of the reports has, in most cases, been delayed by several years. Pantex officials cite a shortage of safety engineers as the primary cause of the delays. Many of the safety analysis reports that have not been completed and have been delayed are for facilities that are involved in Pantex's ongoing effort to disassemble thousands of retired nuclear weapons.

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## Recommendations

In GAO's view, DOE's ambitious disassembly schedule, coupled with unresolved safety issues, could lead to a conflict between safety and production goals. Therefore, GAO recommends that the Secretary of Energy reevaluate Pantex's disassembly schedule in view of past performance and potential future manpower, technical, and safety problems. This reevaluation should ensure that the schedule for the number of nuclear weapons to be disassembled at Pantex is at a level that allows for the resolution of safety problems.

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## Agency Comments

GAO discussed the facts in this report with DOE headquarters, Albuquerque Operations Office, and Oak Ridge Operations Office officials responsible for disassembling retired nuclear weapons and with representatives of DOE's operating contractor at Pantex. Changes were made where appropriate. However, as requested, GAO did not obtain written comments from DOE on a draft of this report. DOE officials commented that a discussion of Pantex's not meeting fiscal year 1992 disassembly goals should not be treated in a negative manner. When safety problems occurred that decreased Pantex's capability to meet the schedule, DOE revised the schedule accordingly. DOE officials also commented that safety is not solely dependent on safety analysis reports but that the reports are the preferred basis for operations. DOE will produce safety analysis reports for all operations and is developing a new schedule for completing them. As a result, DOE Albuquerque officials believe that judging Pantex's performance on the basis of past schedules is not valid and that safety analysis reports produced in accordance with the new schedule should be considered to be on time.

# Contents

<b>Executive Summary</b>		2
<b>Chapter 1</b>		8
<b>Introduction</b>	The United States Has Made Reductions in the Nuclear Weapons Stockpile	8
	DOE Plans to Disassemble Thousands of Retired Nuclear Weapons	9
	Objectives, Scope, and Methodology	10
<b>Chapter 2</b>		13
<b>Transportation and Safety Problems Have Limited Nuclear Weapons Disassemblies at Pantex</b>	DOE's Disassemblies Fell Behind Schedule in 1992	13
	DOE Attempted to Increase Number of Disassemblies	15
<b>Chapter 3</b>		17
<b>Several Issues Affect DOE's Plans for Future Weapons Disassemblies</b>	More Technicians Needed to Meet DOE's Disassembly Schedule	17
	Technical Concerns Must Be Overcome to Meet Disassembly Schedule	18
	Meeting Disassembly Schedule Could Strain Storage Capabilities	18
	Conclusions	20
	Recommendation	21
<b>Chapter 4</b>		22
<b>Safety Analysis Reports Not Completed for Some Disassembly Activities</b>	Uncompleted Safety Analysis Reports Have Been a Long-Term Problem at Pantex	22
	Safety Analysis Reports for Disassembly Activities Remain Uncompleted	24
	Safety Analysis Reports for Oak Ridge Facilities Need to Be Upgraded	25
<b>Appendix</b>	Appendix I: Major Contributors to This Report	28

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**Contents**

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**Abbreviations**

DOD	Department of Defense
DOE	Department of Energy
SST	Safe Secure Trailer
WR	War Reserve

# Introduction

The Department of Energy (DOE) is responsible for researching, developing, testing, assembling, and disassembling nuclear weapons. Over the past few years, international treaties and other nuclear weapons retirements have resulted in dramatic reductions in the nation's nuclear weapons arsenal. Consequently, the nation's nuclear weapons arsenal has been reduced from about 21,000 warheads and bombs in 1990 to a planned stockpile of 3,500 nuclear systems in 2003. In order to accommodate the weapons reductions, DOE has begun the largest nuclear weapons disassembly effort since the 1960s.<sup>1</sup>

## The United States Has Made Reductions in the Nuclear Weapons Stockpile

Since 1990, when the United States had about 21,000 nuclear weapons, the actual and projected number of nuclear weapons in the nuclear weapons arsenal has decreased dramatically. Retirements of weapons that the Department of Defense (DOD) is not planning to replace, retirements resulting from international treaties and agreements, and a presidential initiative to retire a large number of nuclear weapons contributed to this decrease.

The Intermediate-Range Nuclear Forces Treaty, signed in December 1987, did not specifically eliminate any nuclear weapons. It did, however, eliminate delivery systems for the nuclear weapons. As a result, thousands of nuclear weapons associated with the eliminated delivery systems were no longer useful and were either retired or placed into inactive reserve. In July 1991, the signing of the Strategic Arms Reduction Talks (START) treaty resulted in the retirement of 10 nuclear submarines and a large number of missiles. Shortly thereafter, in September 1991, the President announced a new arms control initiative that resulted in the withdrawal of the Army's nuclear weapons from overseas bases and the retirement of several thousand nuclear warheads.

During 1992, the nuclear weapons stockpile was further reduced. For example, the President's 1992 State of the Union address included an announcement of additional unilateral reductions. The reductions included the elimination of warhead delivery systems and nuclear warheads and the conversion of some nuclear weapons carriers to conventional weapons carriers. Finally, on June 17, 1992, the President announced that continued discussions with the leadership of the Commonwealth of Independent States had resulted in an agreement to

<sup>1</sup>DOE defines weapons disassembly as the removal and disposition of the high-explosive main charge around the fissile nuclear material. The final disposition of special nuclear materials such as plutonium and highly enriched uranium is not considered in this definition.

reduce our nuclear weapons stockpile to an arsenal of about 3,500 by 2003.

## DOE Plans to Disassemble Thousands of Retired Nuclear Weapons

As a result of the treaties and agreements, thousands of nuclear weapons have been retired. Retired weapons may be either stored or disassembled. (See footnote 1.) DOE has been disassembling nuclear weapons for more than 45 years. To deal with the large number of retired weapons, DOE began a program to increase its capacity to disassemble the retired nuclear weapons. Most retired nuclear weapons are disassembled at DOE's Pantex Plant near Amarillo in the Texas panhandle. Managed and operated by Mason & Hanger-Silas Mason Company, Inc., Pantex has been assembling and disassembling nuclear weapons since 1951.<sup>2</sup>

In September 1990, DOE established a goal of disassembling a large number of nuclear weapons per year at Pantex to eliminate the backlog of retired weapons. At that time, DOE planned to maintain that rate through fiscal year 1993 or 1994 and then decrease the rate for fiscal year 1995, when the backlog would be substantially reduced. DOE's planning for disassembling nuclear weapons covers a 10-year period. According to DOE officials, the scheduling of weapons types to be disassembled during the first year of the period is reasonably firm; however, the schedule for the remaining years is less firm and more subject to change.

According to DOE officials, a major factor in their decision to disassemble the weapons at a rapid rate was DOE's belief that storing disassembled weapons presents a lower security and safety threat than storing assembled nuclear weapons. According to DOE officials, the risk of accidental nuclear detonation is eliminated in disassembled weapons—that is, weapons in which the high explosive has been separated from the plutonium. In addition, many weapons scheduled for disassembly in the near future are older weapons with safety features that are not as effective as the safety features (such as insensitive high explosives and fire-resistant pits—see footnote 4) on newer systems.<sup>3</sup> Finally, DOE officials believe that, because the various parts of the weapon are separated and stored in different areas, disassembled weapons are a much less attractive target for theft and acts of sabotage.

<sup>2</sup>In this report, references to Pantex officials denote Mason & Hanger-Silas Mason Company, Inc., officials.

<sup>3</sup>Insensitive high explosives are explosives that are less susceptible to detonation from a variety of credible abnormal events. Such abnormal events include a high-velocity impact, projectile attack, fuel or propellant fire, and sympathetic detonation.

In general, for warhead disassembly, the procedures followed to assemble a nuclear weapon are reversed. After a weapon is retired and shipped to Pantex (except for the W-33 weapon), it is subjected to safeguards and safety verifications and inspections. A weapon is then moved to an "operations bay," where mechanical disassembly of the weapon is performed. The assembly containing the plutonium and the high explosive is moved into a "gravel gertie cell," where the high-explosive material is removed from the pit.<sup>4</sup> High-explosive materials are disposed of by burning at Pantex. Pits are stored in secure storage magazines at Pantex, and weapons secondaries are shipped to the Y-12 plant in Oak Ridge, Tennessee, for the disassembly and disposition of their parts.<sup>5</sup> Tritium (a gas used to boost the explosive power of a nuclear weapon) reservoirs are returned to DOE's Savannah River Site near Aiken, South Carolina, where the tritium is recycled.

## Objectives, Scope, and Methodology

The Chairman, Senate Committee on Governmental Affairs, asked us to examine how DOE is addressing the disassembly of retired nuclear weapons. In subsequent meetings with Senate Governmental Affairs Committee staff members, we agreed to provide information on three issues. These issues were (1) DOE's success to-date in meeting the disassembly schedule and the causes of any shortfalls, (2) issues which could affect DOE's ability to meet the disassembly schedule in the future, and (3) uncompleted safety analysis reports.

To determine DOE's success in meeting its planned weapons disassembly schedule, we reviewed DOE's Planning and Production Directives, which contain DOE's weapons retirement plans as directed by the President and the Joint Chiefs of Staff. We also reviewed the documents prepared by DOE's Albuquerque Field Office and Defense Programs Division to direct Pantex and the Y-12 plant on specific short-term monthly weapons disassembly rates. We observed Pantex's disassembly and special nuclear material storage operations and discussed the disassembly process with Pantex and Y-12 plant operating contractor officials. Finally, we discussed weapons disassembly scheduling and the causes of disassembly shortfalls with DOE officials from the Defense Programs Division, the Albuquerque Field Office, the Amarillo Area Office, and the Y-12 plant.

<sup>4</sup>A pit is a metal casing containing plutonium and other material. The pit is where the fission explosion originates.

<sup>5</sup>A nuclear weapon secondary is an assembly in a nuclear weapon where a fusion explosion originates.

To identify issues which could affect DOE's ability to meet its disassembly schedule in the future, we reviewed DOE's plans for future nuclear weapons disassembly and special nuclear material storage. Through discussions with DOE, Pantex, and state of Texas regulatory officials, we identified issues which could affect DOE's ability to continue disassembling weapons and storing plutonium at Pantex. We also discussed with staff members of the Defense Nuclear Facilities Safety Board potential safety problems involved in storing and inventorying large quantities of plutonium at Pantex.

To address the issue of uncompleted safety analysis reports, we interviewed DOE headquarters officials involved in safety oversight and Pantex and Y-12 plant officials responsible for documenting and assuring safety in weapons disassembly and special nuclear materials operations. We reviewed the completion schedule for Pantex's safety analysis reports and previous evaluations of the completion success rate for the reports. We discussed with DOE and Pantex officials the reasons for delays in completing safety analysis reports and the actions necessary to improve the completion rate for safety analysis reports. We also identified safety-related incidents which occurred during the weapons disassembly process and reviewed documentation on unusual occurrences to determine the safety impact of the occurrences and measures being taken to prevent recurrence.

We conducted our review between December 1991 and June 1993 in accordance with generally accepted government auditing standards. We discussed the contents of this report with DOE officials responsible for weapons disassembly programs at the Oak Ridge Operations Office, the Albuquerque Operations Office and headquarters. Changes to this report were made where appropriate. However, as requested, we did not obtain written agency comments on a draft of this report. Overall, DOE officials commented that a discussion of Pantex's not meeting fiscal year 1992 disassembly goals should not be presented in a negative manner. When potential safety or health problems emerged, the disassembly process was halted, the root cause was investigated, a corrective action was developed, and disassembly was restarted. DOE officials said that they believed this methodology to be a strength of the program, not a weakness.

DOE Albuquerque officials told us that Pantex will produce safety analysis reports for all nuclear and nonnuclear operations in accordance with current requirements. They stress that safe facility operation is not solely dependent on safety analysis reports. They stated that safety analysis

reports are the preferred basis for operations; however, it is acceptable to rely on other measures for safe operations, especially for short periods or low-hazard operations. This concept is called "basis for interim operations." According to DOE Albuquerque officials, Pantex has submitted a basis for interim operations for all hazardous facilities. The suitability of the basis for interim operations is currently under DOE review.

Pantex has also submitted a plan for implementing DOE Order 5480.23. The plan (first submitted in February 1993 but currently being revised by Pantex) will show a new schedule for upgrading existing safety analysis reports and for delivering safety analysis reports. DOE Albuquerque officials said that they believe safety analysis reports produced in accordance with this new schedule should be considered to be "on time." They said that judging Pantex's performance in completing safety analysis reports on the basis of past schedules is not valid. While the new schedule was not available to us because it was still being revised, DOE Albuquerque officials told us that all safety analysis reports for nuclear and nonnuclear facilities at Pantex will be delivered to DOE by 1996, "if the current schedule can be sustained." The Albuquerque officials also said that they do not consider that an extensive backlog of uncompleted safety analysis reports exists at Pantex.

# Transportation and Safety Problems Have Limited Nuclear Weapons Disassemblies at Pantex

At the beginning of fiscal year 1992, DOE had planned to disassemble a large number of retired nuclear weapons at the Pantex facility during fiscal year 1992. A much smaller number of disassemblies were scheduled for DOE's Y-12 plant. During fiscal year 1992, transportation and safety problems limited the number of disassemblies at Pantex, and the disassembly goal had to be decreased several times during the year. DOE substantially increased the number of retired weapons disassemblies at its Y-12 plant during fiscal year 1992 and postponed quality assurance tests at Pantex to make additional staff available for retired weapons disassembly. The net result was that DOE was able to disassemble about 86 percent of the weapons originally scheduled for both plants combined. Pantex disassembled about 63 percent of its original goal, while Y-12 disassembled about 580 percent of its goal.

## DOE's Disassemblies Fell Behind Schedule in 1992

In September 1991, DOE planned to disassemble a large number of retired nuclear weapons in fiscal year 1992. The number of weapons planned for disassembly in fiscal year 1992 was far greater than the number of weapons disassembled in prior years. For example, from 1986 through 1990, the highest number of disassemblies conducted was less than one-half the number scheduled for fiscal year 1992. In addition, DOE has not sustained a level of disassemblies as high as that planned for fiscal years 1992 to 1994 since the 1960s and early 1970s. About 96 percent of the fiscal year 1992 weapons were scheduled for disassembly at Pantex; the remaining 4 percent were scheduled for disassembly at Y-12. DOE officials told us that the schedule was based on Pantex's capacity to disassemble nuclear weapons and on the need to disassemble less-safe weapons as soon as possible.

The contract which DOE has with the operator of the Pantex facility is a cost-plus-award-fee contract, whereby the contractor can receive an award or bonus if it meets a number of performance criteria. Achieving 97 percent of the approved schedule for production and disassembly activities is one of the criteria that was used to determine the award fee in fiscal year 1992. Overall, operations and weapons comprise 15 percent of the performance criteria. Other criteria are general management (10 percent); environment, safety, and health (55 percent); safeguards and security (10 percent); and resources and business management (10 percent).

During fiscal year 1992, Pantex actually dismantled only about 63 percent of the weapons originally planned for that year. Safety and transportation

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**Chapter 2**  
**Transportation and Safety Problems Have**  
**Limited Nuclear Weapons Disassemblies at**  
**Pantex**

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problems that slowed or temporarily halted the disassembly process were the reasons for the lower number of disassembled weapons. Because of these problems, DOE lowered the disassembly goal for Pantex during the year. The final goal for Pantex was about 77 percent of its original goal. Using the reduced Pantex goal, about 81 percent of the weapons on the revised schedule were disassembled at Pantex.

As a result, in the second half of fiscal year 1992, Pantex's award fee under its contract with DOE was reduced because Pantex did not meet the schedule for disassemblies. Pantex was cited for a "notable deficiency" in meeting its performance goal of 97 percent of scheduled operations. According to DOE, the deficiency "was the result of an inadequate performance in War Reserve (WR) Disposal activities . . ." The award fee determination also said that Pantex's "inability to consistently meet WR Disposal schedules impacts the President's dismantlement program, the DOE transportation system, and DOD logistics." Performance in this area contributed to the overall recommendation that Pantex receive 20.75 percent of the maximum award fee (\$1.1 million of a maximum possible award of \$5.1 million).

The Oak Ridge Y-12 plant was also scheduled to disassemble a small number of nuclear weapons during fiscal year 1992. As discussed later, the Y-12 plant disassembled about 580 percent of the scheduled quantity.

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**Transportation Delays**  
**Affected Pantex's**  
**Disassembly Work**

DOE transports nuclear weapons in specially built tractor trailers called "Safe Secure Trailers" (SST). In July 1991, an SST experienced an operational failure. The nature of the failure called into question the reliability of the entire SST fleet. As a result of this incident, DOE officials suspended all weapons movements until they evaluated the incident. After 60 days, compensatory actions were taken and DOE resumed transportation activities.

When the incident occurred, Pantex had a 30-day supply of weapons awaiting disassembly. Because the suspension of transportation activities lasted 60 days, Pantex's disassembly work was slowed to avoid depletion of its inventory of weapons to be disassembled. According to Pantex officials, this delay reduced the overall number of fiscal year 1992 weapons disassemblies at Pantex by about 100.

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## Safety Problems Slowed Pantex's Disassembly Work

Several disassembly safety problems also slowed Pantex's weapon disassembly rate in fiscal year 1992. In one case, DOE's laboratories found that a safety situation could occur if a valve on a weapon's reservoir opened because of an electrostatic discharge. This could allow material in the weapon's reservoir to enter the pit. Eleven weapons systems—mostly older systems—are susceptible to this problem. All disassembly work on the 11 systems was suspended, and procedures were developed for each system to provide a positive indication that the valves had not opened prior to disassembly. During fiscal year 1992, only about 64 percent of the scheduled weapons affected by this problem were disassembled.

A second disassembly safety problem at Pantex involved the possibility of exposing disassembly technicians to uranium oxide and thorium during disassembly operations on the W-55 nuclear weapon. As a result, W-55 disassembly was stopped to install additional safety equipment to protect the disassembly technicians. Because of this problem, about 25 percent of the scheduled W-55 disassemblies were accomplished during fiscal year 1992. W-55 disassembly has been reprioritized and is now scheduled to restart in fiscal year 1997.

On May 18, 1992, a problem occurred during disassembly of a B-57 nuclear weapon. While rotating a cased B-57 subassembly, the assembly was dropped about 20 inches and landed on a disassembly stand. No contamination was found, and no damage was reported other than a gouge in the casing. DOE's investigation found that approved procedures and tooling were being used but that the assembly was not properly secured. The technicians performed the first step of a two-part procedure to secure the assembly but were distracted because they had to look for a required cable. Upon resumption of the process, the second step of the procedure was not performed. As a result of this accident, all B-57 operations were halted for 38 calendar days until the investigation was completed, thereby delaying disassembly of 15 weapons.

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## DOE Attempted to Increase Number of Disassemblies

Because of the previously mentioned problems, Pantex fell behind in its efforts to disassemble the scheduled number of retired nuclear weapons during fiscal year 1992. In an attempt to increase the total number of disassemblies and achieve the scheduled rate of disassemblies, DOE made more technicians available to the disassembly effort by postponing quality assurance tests and by increasing the number of disassemblies performed at DOE's Y-12 plant.

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**Chapter 2**  
**Transportation and Safety Problems Have**  
**Limited Nuclear Weapons Disassemblies at**  
**Pantex**

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In order to increase the number of Pantex staff available to conduct weapons disassemblies, DOE postponed 39 quality assurance tests from fiscal year 1992 to fiscal year 1993. Quality assurance tests are routinely performed to assure the reliability of the nuclear weapons currently in the U.S. nuclear arsenal. Quality assurance tests are normally spread out over time to accommodate Pantex's workload-leveling objectives. According to DOE's weapons quality assurance and testing officials, the reduction in quality assurance tests will not reduce DOE's ability to assure the integrity of the existing stockpile. DOE officials believe that a delay in testing of up to 3 years (depending on the weapon) will not affect the quality assurance program because the reliability of older weapons systems can be assured on the basis of past quality assurance tests.

DOE conducted the postponed tests during the first half of fiscal year 1993. However, during the first half of fiscal year 1993, Pantex fell behind in conducting quality assurance tests scheduled for the year. As of March 31, 1993—halfway through the fiscal year—Pantex had conducted about 24 percent of those scheduled for the year.

As mentioned earlier, DOE attempted to offset disassembly shortfalls at Pantex by increasing disassemblies at DOE's Y-12 plant. A small number of W-33 nuclear weapons disassemblies were scheduled to be performed at the Y-12 plant during fiscal year 1992. The W-33 weapon entails a relatively simple design containing uranium but no plutonium. Disassembly of W-33s is performed entirely at the Y-12 plant and does not involve the Pantex facility. In order to increase the overall number of disassemblies completed during fiscal year 1992, DOE increased the disassembly effort at the Y-12 plant. About 580 percent of the weapons originally scheduled for disassembly at Y-12 were actually disassembled. According to Y-12 officials, Y-12 was able to accomplish the increased disassembly work because of the simplicity of the weapon and because of a new procedure that drastically reduced the time required for W-33 disassembly. No significant safety problems were encountered during this process. DOE has now disassembled all W-33s.

# Several Issues Affect DOE's Plans for Future Weapons Disassemblies

DOE currently plans to dispose of the backlog of retired nuclear weapons between fiscal year 1993 and fiscal year 1997. To accomplish this schedule, DOE will have to address a number of issues relating to weapons disassembly and special nuclear material storage that could decrease DOE's capability to disassemble nuclear weapons. These issues include (1) a shortage of disassembly technicians, (2) technical weapons disassembly concerns, and (3) the safety and environmental implications of storing large quantities of plutonium at Pantex.

## More Technicians Needed to Meet DOE's Disassembly Schedule

According to Pantex officials, hiring, training, and granting security clearances to a sufficient number of weapons disassembly technicians are the biggest challenge facing Pantex as it increases its disassembly workload. In addition to the inherent staffing demands of an increasing disassembly workload, Pantex must hire additional technicians to make up for unexpected attrition during 1991. Pantex's ability to disassemble the scheduled weapons during fiscal year 1993 will depend on its ability to attract and train qualified technicians.

Pantex officials estimate that they will need 333 technicians to conduct disassembly, evaluation, and modification/rehabilitation activities over the next few years. Pantex is currently authorized 313 technicians but has only 287 on-board because of an unexpectedly high rate of attrition. During fiscal year 1991, Pantex lost 46 technicians: 13 retired, 22 transferred to other jobs, 10 were promoted, and 1 was terminated. Pantex plans to replace these technicians with 33 workers transferring from other jobs and 13 new hires. Twelve of the transfers will be from Pantex's security force. Pantex also recruited 15 technicians from DOE's Kansas City facility; however, all but 4 were eliminated during the security clearance process.

Even if Pantex is successful in replacing the 46 technicians, they will not be available for disassembly activities for an extended period. Pantex officials estimate that once a "quality" recruit is identified, obtaining required clearances and training requires about 18 months. The total cost of hiring a new technician, including training and clearances, is about \$50,000 per technician.

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## Technical Concerns Must Be Overcome to Meet Disassembly Schedule

In order to have a more manageable workload during fiscal year 1993, DOE decided to run fewer disassembly lines. It planned to disassemble a larger number of a few types of weapons instead of disassembling a smaller number of many types of weapons. DOE had planned to run four lines during fiscal year 1993, but because of a safety question resulting from a W-48 weapon disassembly problem, only three lines were operated.

During fiscal year 1993, DOE planned to disassemble a large number of W-48 nuclear weapons. The disassembly process for the W-48 involves using hot water to remove the nonnuclear high explosive from the pit. In November 1992, while the high explosive was being removed from the pit of a W-48, technicians found that the shell of the pit had cracked. Disassembly of all W-48s was halted. Initially, DOE officials were concerned that radioactive contamination could result. DOE officials surveyed the area and found contamination only in the pan holding the pit. Further study resulted in developing an alternative method of disassembly. Disassembly of the W-48 will resume in fiscal year 1994 after certification of new tooling and procedures is completed. DOE officials told us that the problem with W-48 disassemblies has impaired their ability to reach the fiscal year 1993 disassembly goal by about 25 percent.

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## Meeting Disassembly Schedule Could Strain Storage Capabilities

As a result of the nuclear weapons disassembly program, large quantities of plutonium will require safe and secure storage. DOE currently plans to store the plutonium in pit form at its Pantex facility until a long-term storage site is identified. In order to store all pits in existing facilities at Pantex, however, additional plutonium pit storage capacity will be needed, and a safety analysis report and an environmental assessment for the storage must be completed. If these items are not completed in a timely manner, Pantex will run out of storage space and disassembly efforts will have to be curtailed. In addition, Texas state officials have expressed concerns over the environmental and safety impacts of storing a large amount of plutonium at Pantex. If these concerns affect plutonium storage at Pantex, disassembly activities could also be adversely affected.

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## Pantex Needs to Expand Plutonium Storage Space

As a result of the nuclear weapons disassembly program, large numbers of pits will require safe, secure storage. The pits disassembled at Pantex contain plutonium, a radioactive element with a half-life of about 24,000 years. In the past, plutonium was recycled at DOE's Rocky Flats plant in Colorado. However, the recycling facilities at Rocky Flats are not in operation. DOE officials informed us that they plan to store plutonium pits

at Pantex on an interim basis until a decision on long-term storage or reprocessing of plutonium is made.

Pantex is currently authorized to store about 6,800 pits, on an interim basis, in storage magazines, a vault, and a cell converted to store special nuclear materials. DOE has proposed that, instead of storing pits in a single layer in the magazines, the pits be horizontally stacked. If horizontal stacking were implemented and additional magazines were made available, total pit storage capacity at Pantex would increase to more than 20,000 pits. DOE officials estimate that existing facilities will provide adequate storage until about April 1994. At that time, additional storage capacity will be needed to allow Pantex to continue to disassemble nuclear weapons.

To enable Pantex to horizontally stack plutonium pits, Pantex officials prepared a safety analysis report and an environmental assessment. The safety analysis report has been completed and was approved by DOE in December 1992. DOE is now preparing an operational readiness report to demonstrate that the facility can be operated within the parameters established in the safety analysis report. The environmental assessment has been drafted and was issued for public comment in January 1993.

DOE is aware of at least one health and safety problem associated with storing plutonium pits at Pantex. In order to account for and assess the condition of the plutonium stored at Pantex, DOE requires that periodic physical inventories be taken at storage facilities. However, physical inspections of the stacked storage areas would expose Pantex personnel to high levels of radioactivity. Conducting a physical inventory in the storage magazines requires that two people spend 3 hours in each magazine. If plutonium pits are horizontally stacked, exposures to personnel are estimated to be 0.1 rem<sup>1</sup> per hour, or 0.3 rem per person per magazine. DOE estimates that, at this rate of exposure, 10 people would receive more than the maximum allowable yearly exposure of 1 rem from a single physical inventory of all the storage magazines.

To reduce exposures to employees under the current storage arrangement, Pantex has obtained an exemption from conducting monthly physical inventories of interim pit storage facilities. Instead, physical inventories will be conducted every 18 months. The exemption was granted by DOE's Office of Security Affairs on January 12, 1993. DOE officials informed us

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<sup>1</sup>A rem is a unit of dose of any ionizing radiation that produces the same biological effect as a unit of absorbed dose of ordinary X-rays.

that for the currently authorized storage configuration, the exemption will result in a reduction in overall exposures. On April 16, 1993, DOE authorized a change in the single-layer storage configuration that will allow increased storage capacity without a corresponding increase in exposures—as long as the inventory exemption is in force. Under the new arrangement, pit containers are placed on casters and rolled into the storage magazines. The additional containers fill the center aisles that in the past were required to be vacant to accommodate inventory operations.

To reduce exposures if horizontal stacking of pits is implemented, DOE is taking several actions. To reduce exposures during inventory and stacking operations, DOE has had a shielded forklift designed and built. In addition, an "Automated Guided Vehicle" to allow for remote handling and inventorying of pit containers is in the final stages of design. DOE expects the vehicle to be available for operation in the middle of fiscal year 1994.

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### Safety and Environmental Concerns Expressed by State of Texas Officials

Officials representing the state of Texas have raised concerns about the safety and environmental impact of plutonium pit storage at Pantex. These concerns focus on storing plutonium at Pantex and the effect that such storage would have on a local aquifer. Texas officials are concerned that DOE has not performed the safety analysis reports necessary to assure that plutonium storage at Pantex does not pose a safety risk. The currency of Pantex's safety analysis reports is discussed in chapter 4 of this report.

Texas officials' major environmental concern is the potential affect of long-term plutonium storage on the underlying Ogallala Aquifer. The aquifer supports ranchers and farmers in the area surrounding Pantex and throughout the central United States, and provides drinking water to Amarillo and other nearby communities. The Governor stated that "any adverse impact to the Ogallala aquifer would be unforgivable." DOE has provided about \$6 million to the Bureau of Economic Geology at the University of Texas for a geological and hydrological site characterization study of Pantex.

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### Conclusions

DOE has established a very ambitious schedule for disassembling retired nuclear weapons at its Pantex facility. During fiscal year 1992, DOE did not meet its schedule, disassembling only about 63 percent of the planned number of retired weapons at Pantex because of transportation delays and safety problems that arose with specific weapons systems.

Although we found no cases where DOE or Pantex officials gave priority attention to disassembly goals over safety, we are concerned that conflicts may arise in the future. DOE has established disassembly goals for a 10-year period. While the number and type of weapons to be disassembled are reasonably firm for the first year, DOE officials said that, beyond the first year, the schedule is more subject to change. When ambitious operational goals are established and safety issues have the potential to impede achievement of those goals, there is always concern that safety could be sacrificed. Along with meeting ambitious operational goals, DOE, in future years, will have to address many significant budgetary, safety, and environmental issues. These include (1) the need for more technicians, (2) technical problems with certain types of weapons, and (3) plutonium storage and environmental issues such as the potential contamination of the Ogallala Aquifer.

In our view, an ambitious schedule, coupled with unresolved safety issues, could lead to a conflict between safety and production goals. In light of manpower, technical, safety, and environmental problems known to exist, and past experience with unanticipated problems, DOE's overall schedule for disassembling weapons may not be appropriate. Reevaluation of the disassembly schedule may be necessary to ensure that safety problems can be adequately resolved without falling short of disassembly goals.

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## **Recommendation**

Because manpower, technical, safety, and environmental issues could affect Pantex's ability to meet disassembly goals, we recommend that the Secretary of Energy reevaluate Pantex's disassembly schedule. This reevaluation should ensure that the schedule for the number of weapons disassembled is at a level that allows for the resolution of safety problems.

# Safety Analysis Reports Not Completed for Some Disassembly Activities

DOE requires safety analysis reports for all its facilities. Safety analysis reports are important because they establish a basis for both DOE and its operating contractors to (1) determine that a facility can operate safely and (2) conclude that operating the facility does not pose an unacceptable risk to public health and safety. Prepared by the operating contractor, a safety analysis report compares the facility with its design criteria and analyzes potential accidents that could release radioactive materials to the environment. This information is used to identify potential problems so that corrective action can be taken.

Completion of safety analysis reports has historically been a problem at DOE's Pantex facility. This problem still existed in December 1992 as Pantex had completed less than 50 percent of the required safety analysis reports. Completion of the reports had, in most cases, been delayed by several years. Some of the safety analysis reports that had not been completed and had been delayed were for facilities that are involved in Pantex's ongoing effort to disassemble thousands of retired nuclear weapons. In the summer of 1993, Pantex was in the process of revising its safety analysis report delivery schedule and its safety analysis report upgrade plan. While DOE's Y-12 plant at Oak Ridge, Tennessee, has completed required safety documents for all facilities, none of the plant's reports comply with new safety analysis requirements. A plan has been developed to bring the documents into compliance.

## Uncompleted Safety Analysis Reports Have Been a Long-Term Problem at Pantex

DOE has required safety analysis reports for all its defense nuclear facilities since 1976. Safety analysis reports are needed to help assure that nuclear facilities are safely designed, constructed, and operated and must illustrate how a facility's systems, components, and structures meet established design criteria. In 1992, DOE Order 5480.23 broadened and made more definitive the guidance on the format and content of safety analysis reports to make DOE's reports similar to Nuclear Regulatory Commission practice.

Safety analysis reports are required to contain information on a site's characteristics, facility operation, health and safety criteria, radioactive and hazardous waste management, radiation protection, and human factors. Safety analysis reports also must analyze potential accidents that could release radioactive materials. The comparison of a facility with the design criteria for that type of facility and the accident analyses are to be used to identify problem areas. Contractors are required to update the

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**Chapter 4**  
**Safety Analysis Reports Not Completed for**  
**Some Disassembly Activities**

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safety analysis reports annually to assure that the information in the documents is current and remains applicable.

Reviews of Pantex's safety analysis report program between 1989 and 1991 found that Pantex had not completed all required safety analysis reports.<sup>1</sup> In June 1989, DOE began a Tiger Team Assessment program—a program intended to provide the Secretary of Energy with information on DOE's facilities' compliance with environmental, safety, and health requirements and the adequacy of DOE's and contractors' environmental, safety, and health programs. From October 2 through October 31, 1989, a DOE Tiger Team Assessment was conducted at DOE's Pantex plant. The team found that safety analysis reports did not exist for about 48 percent of the facilities required to have them. The Tiger Team selected a small sample of facilities at Pantex for specific review and found that, overall, the facilities did not satisfy the standards and that a systematic review of the facilities may be in order.

In April 1991, we issued a report on safety and health problems at DOE's Pantex plant.<sup>2</sup> In that report, we noted that, of the facilities required to have safety analysis reports at that time, about 52 percent had not been completed. Pantex contractor officials blamed a lack of personnel for preventing completion of the reports. We also found that safety analysis reports that had been completed required updating and concluded that, because most of Pantex's safety analysis reports had not been completed or needed to be updated, DOE could not adequately ensure that the plant was operating safely.

From January 27, 1992, through February 7, 1992, DOE's Defense Programs Office of Inspections conducted a technical safety appraisal of the Pantex plant. Technical safety appraisals are multidisciplinary performance appraisals of environmental, safety, and health programs. A plant's performance is evaluated on a baseline established by a previous Tiger Team Assessment (in this case, by the October 1989 Tiger Team Assessment).

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<sup>1</sup>In addition, our 1986 report *Nuclear Safety: Safety Analysis Reviews for DOE's Defense Facilities Can Be Improved* (GAO/RCED-86-175, June 16, 1986) found that (1) safety analysis reviews had not been approved for some facilities, (2) the accident analysis process used in reviews varied from facility to facility, and (3) all reviews and approvals of safety analysis reports were performed in-house—there were no independent reviews.

<sup>2</sup>*Nuclear Health and Safety: More Attention to Health and Safety Needed at Pantex* (GAO/RCED-91-103, Apr. 15, 1991).

The appraisers found that significant progress in improving the environmental, safety, and health programs at Pantex had been made since the Tiger Team Assessment in 1989. In the area of safety analysis reports, however, the assessors found that management was still experiencing a major problem in preparing new safety analysis reports and updating existing reports. About 50 safety analysis reports needed to be written or updated.

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## **Safety Analysis Reports for Disassembly Activities Remain Uncompleted**

Although at least three previous assessments and reviews of environmental, safety, and health since 1989 have reported problems with Pantex's safety analysis reports process, our review showed that the situation has not been corrected. As of December 1992 (the date of Pantex's last approved safety analysis report completion schedule), Pantex had revised the safety analysis report program to consolidate several facilities for reporting purposes. As a result, instead of the 67 or 66 safety analysis reports required in 1989 and 1990, respectively, 42 safety analysis reports were required.<sup>3</sup> Pantex had completed safety analysis reports for only 17 of the 42 operations/facilities. In addition, Pantex had safety analysis reports for parts of five other operations/facilities. Twenty operations/facilities that Pantex has designated as needing safety analysis reports are not covered by any reports.

As of December 1992, the schedule for completing the safety analysis reports had slipped dramatically. In our April 1991 report, we noted that Pantex planned to have all new and updated safety analysis reports submitted to DOE by December 1993. DOE officials informed us that, according to the then-current schedule for the Pantex Plant, all safety analysis reports will not be submitted to DOE until January 1998.

Some of the uncompleted safety analysis reports cover operations and facilities directly related to the weapons disassembly process. According to Pantex records, 18 of the 42 safety analysis reports required are for facilities that are directly involved in disassembly activities. In addition, six safety analysis reports are required for facilities that are indirectly involved in disassembly activities. Of the 24 disassembly facilities required to have safety analysis reports, only 9 have approved safety analysis

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<sup>3</sup>While the percentage of completed safety analysis reports has varied slightly during the period from June 1989 through February 1992, the changes represent no real progress in the number of approved safety analysis reports. The percentage of completed safety analysis reports has changed because the number of facilities required to have the reports has changed. However, during this period, no safety analysis reports were completed by Pantex or approved by DOE. Subsequent to this period, in December 1992 (as discussed in ch. 3), DOE approved a safety analysis report for plutonium pit storage.

reports, and 3 additional facilities have approved reports for part of the operation/facility.

Many of the disassembly facilities needing safety analysis reports or revisions to existing safety analysis reports are involved in disassembly activities that have been rated as posing a moderate safety risk. (Pantex has no facilities that are judged as having a high risk.) For example, weapons bays and "gravel gertie" cells, where nuclear weapons are disassembled, were scheduled for revisions to their safety analysis reports in 1991 and early 1992. As of December 1992, the completion schedule for these revisions had slipped to spring and summer of 1993. (As discussed later, the safety analysis report schedule is currently being revised.) The high-explosive burning ground at Pantex is a 54-acre area where high explosives and industrial waste containing high-explosive material are burned. A safety analysis report has never been completed for this site and is not scheduled to be completed until September 1994.

According to Pantex and DOE officials responsible for developing safety analysis reports, the delays in safety analysis report completion have been caused by a shortage of personnel, including qualified safety engineers. The Pantex contractor has addressed this problem by hiring a subcontractor to prepare some safety analysis reports. But according to Pantex and DOE officials, this is not an ideal solution because a large amount of detailed information that should be retained by engineers for work on future safety analysis reports is lost.

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## Safety Analysis Reports for Oak Ridge Facilities Need to Be Upgraded

As discussed in chapter 2, DOE's Y-12 plant at its Oak Ridge, Tennessee, site disassembles some nuclear weapons that contain no plutonium and all secondaries that are removed from nuclear weapons at Pantex. In past years, Y-12 prepared and had DOE approve various required safety documents (including six safety analysis reports and five operational safety requirements with technical basis documents) to support the plant's operations. None of these documents, however, meet new DOE requirements.

In 1989, DOE and Martin Marietta, the Y-12 operating contractor, formed a joint working group to develop a strategy for updating the safety documents to meet current standards. They developed an approach by which all operations would be reviewed to identify and eliminate from further evaluations those operations that involve insignificant hazards or for which standard industrial practices are adequate to define safe

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**Chapter 4**  
**Safety Analysis Reports Not Completed for**  
**Some Disassembly Activities**

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practices. For operations that were not eliminated, safety evaluations would be conducted in more detail, depending on the level of risk involved. A "safety assessment" would be conducted for all facilities or operations categorized as minor hazards. Safety analysis reports would be required for all operations with hazards classified as greater than minor. Y-12 officials believe that 26 safety analysis reports must now be prepared to meet DOE's requirements. The goal of this effort is to complete all required safety analysis reports from 1994 to 1998.

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Major differences exist between the requirements for nuclear facilities that are not weapons related and those facilities involved with nuclear weapons. The Defense Nuclear Facilities Safety Board has cited these differences while stating that they consider that certain basic safety principles apply to the handling of nuclear material, regardless of the form the material is in. In a January 21, 1993, recommendation to the Acting Secretary of Energy, the Defense Nuclear Facilities Safety Board stated that a number of DOE orders related to nuclear safety are explicitly excluded from applicability to facilities that assemble, disassemble, and test nuclear weapons. The Safety board recommended that DOE (1) review its orders related to nuclear safety and determine those that apply to facilities that assemble, disassemble, and test nuclear weapons; (2) evaluate the level of nuclear safety assurance provided by the orders and directives applicable to facilities that assemble, disassemble, and test nuclear weapons and compare it with the level of safety assurance provided by orders applicable to other DOE nuclear facilities; (3) develop a plan for any deficiencies found by the above two reviews; and (4) give priority to completing sitewide order compliance reviews at facilities that assemble, disassemble, and test nuclear weapons—with special emphasis on the Pantex plant.



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